

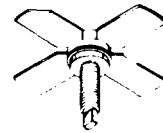
The RF Line
UHF Linear Power Transistors

The TP5002/S are NPN gold metallized transistors using diffused ballast resistors for reliability and ruggedness. They are specifically designed as low power drivers, having high gain and can be operated in Class A, B or C.

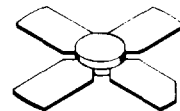
- 380–512 MHz
- 1.5 W — P_{out}
- 24 V — V_{CC}
- High Gain — 13 dB Min, Class A @ 470 MHz

TP5002
TP5002S

1.5 W — 380 to 512 MHz
UHF LINEAR
POWER TRANSISTORS
NPN SILICON



CASE 244C-01, STYLE 1
 (.280 SOE)
 TP5002



CASE 249A-01, STYLE 1
 (.280 SOE S)
 TP5002S

MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|--|-----------|-------------|---------------|
| Collector-Base Voltage | V_{CBO} | 45 | Vdc |
| Emitter-Base Voltage | V_{EBO} | 3.5 | Vdc |
| Total Device Dissipation (at $T_C = 25^\circ\text{C}$ Derate above 25°C) | PD | 7 0.045 | Watts W/°C |
| Operating Junction Temperature | T_J | 200 | °C |
| Storage Temperature Range | T_{stg} | -65 to +200 | °C |

THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|---|-----------------|-----|------|
| Thermal Resistance, Junction to Case ($T_C = 70^\circ\text{C}$) | $R_{\theta JC}$ | 21 | °C/W |

ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

OFF CHARACTERISTICS

| | | | | | |
|--|---------------|-----|---|-----|------|
| Collector-Base Breakdown Voltage ($I_C = 2\text{ mA}$, $I_E = 0$) | $V_{(BR)CBO}$ | 45 | — | — | Vdc |
| Emitter-Base Breakdown Voltage ($I_E = 2.0\text{ mA}$, $I_C = 0$) | $V_{(BR)EBO}$ | 4.0 | — | — | Vdc |
| Collector Cutoff Current ($V_{CB} = 24\text{ V}$, $I_E = 0$) | I_{CBO} | — | — | 0.5 | mAdc |

ON CHARACTERISTICS

| | | | | | |
|---|----------|----|---|-----|---|
| DC Current Gain ($I_C = 100\text{ mA}$, $V_{CE} = 5\text{ V}$) | h_{FE} | 15 | — | 120 | — |
|---|----------|----|---|-----|---|

DYNAMIC CHARACTERISTICS

| | | | | | |
|--|----------|---|---|-----|----|
| Output Capacitance ($V_{CB} = 28\text{ V}$, $I_E = 0$, $f = 1\text{ MHz}$) | C_{ob} | — | — | 4.5 | pF |
|--|----------|---|---|-----|----|

FUNCTIONAL TESTS

| | | | | | |
|---|-----------|----|-----|---|----|
| Common-Emitter Amplifier Power Gain ($V_{CE} = 23\text{ V}$, $P_{out} = 1.5\text{ W}$, $f = 470\text{ MHz}$, $I_C = 200\text{ mA}$) | G_{PE} | 13 | — | — | dB |
| Saturated Output Power ($V_{CE} = 23\text{ V}$, $f = 470\text{ MHz}$, $I_C = 200\text{ mA}$) | P_{sat} | — | 2.2 | — | W |

TP5002, TP5002S

TYPICAL CHARACTERISTICS

2

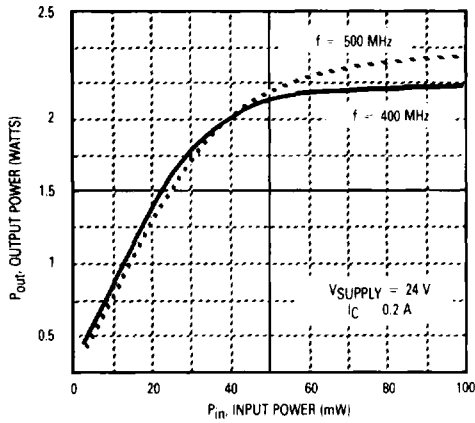


Figure 1. Output Power versus Input Power

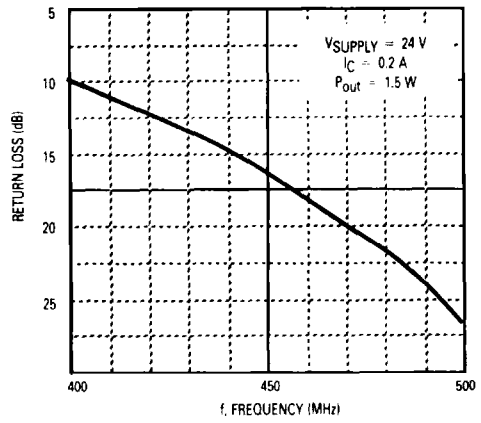


Figure 2. Return Loss versus Frequency

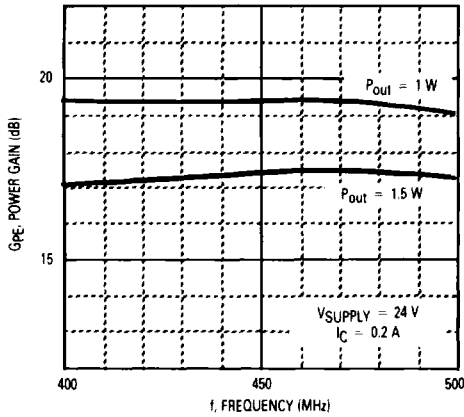


Figure 3. Power Gain versus Frequency

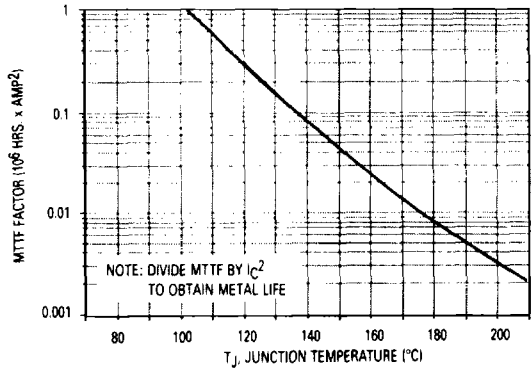


Figure 4. MTTF Factor versus Junction Temperature

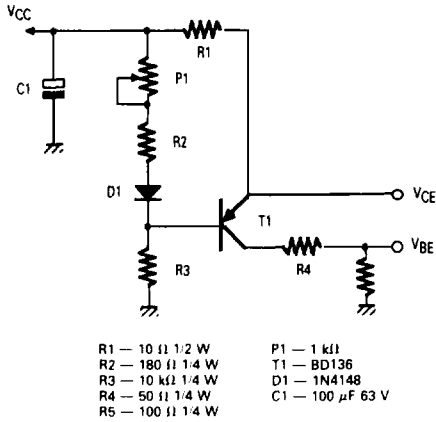


Figure 5. Class A Bias Circuit

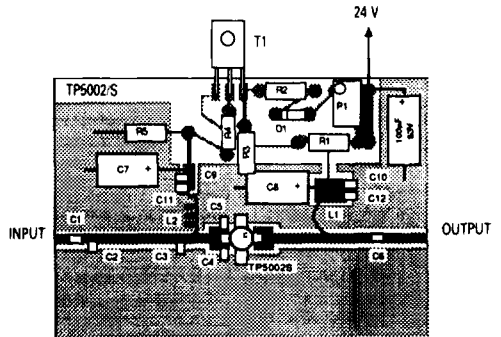
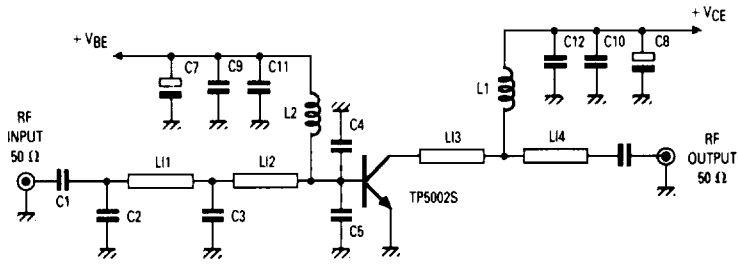


Figure 6. Component Layout

TP5002, TP5002S



C1, C6 — 220 pF 0805 681C Sprague
 C2 — 8.2 pF ATC100A8R2DP50
 C3 — 10 pF ATC100A100DP50
 C4, C5 — 27 pF ATC100A8R2DP50
 C7 — 10 μ F 35 V
 C8 — 100 μ F 63 V
 C9, C10 — 1 nF 0805 681C Sprague
 C11, C12 — 220 pF 0805 681C Sprague

L1 — Microstrip Line W = 2.5 mm $Z_0 = 70 \Omega$, L = 6% λ_g at 470 MHz
 L2 — Microstrip Line W = 2.5 mm $Z_0 = 70 \Omega$, L = 3% λ_g at 470 MHz
 L3 — Microstrip Line W = 2.5 mm $Z_0 = 70 \Omega$, L = 5% λ_g at 470 MHz
 L4 — Microstrip Line W = 2.5 mm $Z_0 = 70 \Omega$, L = 3% λ_g at 470 MHz

Board Material: 1/16 In. Teflon Glass, $\epsilon_r = 2.55$, h = 1.59 mm

L1 — Hairpin wire 1.1 mm L = 33 mm
 L2 — 4 turns, ID 2.5 mm, 0.5 mm wire

Figure 7. 400–500 MHz Broadband Amplifier

| FREQUENCY (MHz) | 400 | 410 | 420 | 430 | 440 | 450 | 460 | 470 | 480 | 490 | 500 |
|---------------------------|------|------|------|------|------|------|------|------|------|------|------|
| RE(Z_{in}) Ω | 2.5 | 2.5 | 2.5 | 2.3 | 2.4 | 2.3 | 2.2 | 2.2 | 2.1 | 2.1 | 2.0 |
| IM(Z_{in}) Ω | 2.0 | 2.2 | 2.7 | 3.2 | 3.5 | 3.8 | 3.9 | 4.0 | 4.2 | 4.9 | 5.0 |
| RE(Z_{load}) Ω | 33.4 | 35.5 | 36.5 | 37.0 | 38.4 | 39.5 | 40.4 | 41.4 | 42.4 | 43.4 | 44.4 |
| IM(Z_{load}) Ω | 48.3 | 48.9 | 49.4 | 49.9 | 50.8 | 50.9 | 51.3 | 51.7 | 52.2 | 52.6 | 53.0 |

Impedance Data
 $V_{CC} = 23$ Volts
 $I_C = 200$ mA
 $P_{out} = 1.5$ Watts